Fishy Frequencies: Background Information

Targeted *Standard Course of Study:* Goals and Objectives

Goal 3: The learner will develop an understanding of the continuity of life and the changes of organisms over time.

3.05: Examine the development of the theory of evolution by natural selection including: Development of the theory, the origin and history of life, fossil and biochemical evidence, mechanisms of evolution and applications

Introduction to the Teacher

This activity shows allele frequencies changing over time as a result of selection and remaining stable without selection. It can be done with or without using the Hardy-Weinberg equilibrium equation depending on the needs of your students. Two different sets of activity sheets are provided so that you can choose. The Hardy Weinberg equilibrium equation allows you to figure out the frequency of alleles and genotypes from the frequency of observable phenotypes in populations that meet the conditions for Hardy Weinberg Equilibrium. These conditions include an infinitely large population, random mating, and no selection, mutation, migration or genetic drift. Of course, no real population completely fits these conditions. When a population or sub-population is not in equilibrium, population biologists can study the factors affecting the distribution of alleles. If your students do the activity using the Hardy Weinberg equation they can see how population biologists estimate the number of organisms heterozygous for a trait from the number of organisms with the recessive phenotype. You can also relate the Hardy Weinberg equation to Punnett squares and use this as an opportunity to show students an application for squaring binomials. Punnett squares can be used to calculate expected phenotype frequencies for populations as well as the expected ratios from individual crosses. You can also take the opportunity to discuss the conditions for equilibrium and in what ways this simulation does and does not meet these conditions.

If you decide that your students are not ready to learn the Hardy-Weinberg equilibrium equation, you can do this same activity and have the students simply calculate the percentages of brown and gold fish in successive generations. By conducting the simulation twice (once without selection and once with selection) students will see changes in percentages and you can help them understand that this means a different percentage of each allele – in other words, allele percentages will have changed over time when a population responds to selective pressures.

In either case, one important difference to be sure students note between this simulation and selection in a natural setting is that in this case the population experiencing selection is being replenished from the "ocean" which is not experiencing selection.